SLOVENSKI STANDARD
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Refrigerating systems and heat pumps - System flow diagrams and piping and instrument diagrams - Layout and symbols

Refrigerating systems and heat pumps - System flow diagrams and piping and instrument diagrams - Layout and symbols

Kälteanlagen und Wärmepumpen - Systemfließbilder und Rohrleitungs- und Instrumentenfließbilder - Gestaltung und Symbole

Systemes de réfrigération et pompes à chaleur - Schémas synoptiques pour systemes, tuyauteries et instrumentation - Configuration et symboles

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ICS:

01.080.30	Grafiļ ni simboli za uporabo v risbah, diagramih, naļ rtih, zemljevidih v strojniġtvu in gradbeniġtvu ter v ustrezni tehniļ ni proizvodni dokumentaciji	Graphical symbols for use on mechanical engineering and construction drawings, diagrams, plans, maps and in relevant technical product documentation
27.080	Toplotne ļ rpalke	Heat pumps
27.200	Hladilna tehnologija	Refrigerating technology

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Descriptors: cooling systems, heat pumps, charts, diagrams, graphic symbols, piping, instruments, information, classifications, presentation, selection

English version

Refrigerating systems and heat pumps - System flow diagrams and piping and instrument diagrams - Layout and symbols

Systèmes de réfrigération et pompes à chaleur - Schémas synoptiques pour systèmes, tuyauteries et instrumentation - Configuration et symboles

Kälteanlagen und Wärmepumpen - Systemfließbilder und Rohrleitungs- und Instrumentenfließbilder - Gestaltung und Symbole

This European Standard was approved by CEN on 23 March 1998.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 182 "Refrigerating systems, safety and environmental requirements", the secretariat of which is held by DIN.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) 1997/23/EC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1998, and conflicting national standards shall be withdrawn at the latest by October 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Recognizing the work already done by other committees, the work has been based on the basic series developed for process plants and other relevant symbol standards. The standard will be revised and harmonized with the relevant standards as soon as these are available.

1 Scope

This European Standard specifies the symbols and drawing rules for system flow diagrams and piping and instrument diagrams to be applied to refrigerating systems including heat pumps. These diagrams represent the configuration and function of refrigerating systems and form a part of the complete technical documentation necessary for designing, construction, installation, commissioning, operation, maintenance and decommissioning of a refrigerating system.

This standard does not apply to refrigerating systems, where the heat is extracted by an electrical circuit, e.g. Peltier-effect.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

ISO 1000
SI units and recommendations for the use of their multiples and of certain other units

ISO 3098-1
Technical drawings – Lettering – Part 1: Currently used characters

ISO 3511-1
Process measurement control functions and instrumentation – Symbolic representation – Part 1: Basic requirements

ISO 3511-2
Process measurement control functions and instrumentation – Symbolic representation – Part 2: Extension of basic requirements

ISO 3511-3
Process measurement control functions and instrumentation – Symbolic representation – Part 3: Detailed symbols for instrument interconnection diagrams

ISO 3511-4
Industrial process measurement control functions and instrumentation – Symbolic representation – Part 4: Basic symbols for process computer, interface, and shared display/control functions

ISO 4196
Graphical symbols – Use of arrows

ISO 5457
Technical drawings – Sizes and layout of drawing sheets

ISO 7200
Technical drawings – Title blocks

ISO 10628
Flow diagrams for process plants – General rules

3 Definitions

For the purposes of this standard, the following definition applies:

flow diagram: Diagram representing the process, configuration and function of a refrigerating system, simplified with the aid of graphical symbols, annotations and alphanumeric codes.

4 Classification, information content and presentation

4.1 General

Depending on the information and presentation, a distinction is made between two types of flow diagrams for refrigerating systems, namely:

- system flow diagram (see 4.2);
- piping and instrument diagram (P & ID) (see 4.3).

Flow diagrams shall take into account the functional requirements.

The graphical presentation shall be in accordance with clause 6. The routes and the direction of flow shall be indicated by lines and arrows.

All pressures indicated on flow diagrams unless otherwise stated are absolute pressures.

4.2 System flow diagram

4.2.1 General

The system flow diagram shall represent a refrigerating system with the aid of graphical symbols interconnected by flow lines (see example in figure A.1).

The graphical symbols represent components and the lines represent streams of mass and energy flows or energy carriers e.g. pipes or wires.

4.2.2 Basic information

The system flow diagram shall use the graphical symbols in accordance with clause 6 and shall at least contain the following information:

a) equipment and machinery necessary for the refrigerating system;

b) designation and flow rates of in- and outgoing products which can be cooled or heated;

c) designation of refrigerant, heat transfer medium, absorbant and adsorbant;

d) characteristic operating conditions.

4.2.3 Additional information

The system flow diagram shall use the graphical symbols in accordance with clause 6 and can also contain e.g.:

a) designation and flow rates of fluids between the process steps;

b) essential valves in the logical position with respect to their function;

c) functional demands for measurement and control at essential points;

d) supplementary operating conditions;

e) characteristic data of equipment, machinery and other components indicated on the drawing or in separate lists.

4.3 Piping and instrument diagram (P & ID)

4.3.1 General

The piping and instrument diagram (P & ID), based on the system flow diagram, shall represent the technical realization of a refrigerating system by means of graphical symbols for equipment, machinery and piping together with graphical symbols for measurement and control functions (see example in figure A.2).

4.3.2 Basic information

The P & ID shall use the graphical symbols in accordance with clause 6 and shall at least contain the following information:

a) designation of refrigerant, heat transfer medium, absorbant and adsorbant;

b) characteristic operating conditions;

c) equipment, machinery and other components (e.g. drives, piping, conveyors, valves and fittings) as well as installed stand-by equipment;

d) characteristic data of equipment, machinery and other components indicated, if necessary, in separate lists;

e) size, pressure rating, material and type of piping, e.g. by piping number, piping class or identification number;

f) thermal insulation;

g) measurement and control functions;

h) safety equipment.

4.3.3 Additional information

The P & ID shall use the graphical symbols in accordance with clause 6 and may also contain e.g.:

a) mass flows and charges of refrigerant and heat transfer medium;

b) route and direction of flow of refrigerant and heat transfer medium;

c) data on the construction of piping, equipment, valves, machinery and thermal insulation indicated, if necessary, in separate lists.

5 Layout of diagrams

5.1 Drawing rules

5.1.1 General

The standardized drawing rules shall be used for the graphical representation of flow diagrams for refrigerating systems.

5.1.2 Drawing sheet sizes

Drawing sheet sizes as shown in ISO 5457 shall be used.

NOTE: Considering the various copying techniques available, long sizes and sizes larger than A0 should be avoided.

5.1.3 Title block

The basic title block for drawings and lists as shown in ISO 7200 shall be used.

5.2 Graphical symbols

The graphical symbols shall be in accordance with clause 6 except that graphical symbols for measurement, control functions and safety equipment shall be in accordance with ISO 3511-1 to ISO 3511-4 (also see annex B).

5.3 Connecting lines

5.3.1 Line width

The line width shall be related to the proposed grid module (M) for flow diagrams M = 2,5 mm.

To obtain a clear representation, different line widths shall be used. Main flow lines or main piping shall be highlighted.

NOTE: The following line widths, chosen from ISO 128 (see annex c), should be used:

a) 1,0 mm (0,4 M) for

- main flow lines;

b) 0,5 mm (0,2 M) for

- graphical symbols for equipment and machinery, except valves, fittings and piping accessories;
- rectangular boxes for illustrating unit operations, equipment, etc.;
- subsidiary flow lines;
- energy carrier lines and auxiliary system lines;

c) 0,25 mm (0,1 M) for

- graphical symbols for valves, fittings and piping accessories;
- symbols for measurement, control functions, safety equipment, control and data transmission lines;
- reference lines;
- other auxiliary lines;

Line widths of less than 0,25 mm (0,1 M) shall not be used.

5.3.2 Line spacing

The minimum spacing between parallel lines shall not be less than twice the width of the thickest line (see ISO 128), but not less than 1 mm.

NOTE: A spacing of 10 mm and more is desirable between flow lines.

5.3.3 Direction of flow

Inlet and outlet arrows as shown in ISO 4196 shall be used for indicating the inlet and outlet of streams into or out of the diagram.

Arrows shall be incorporated in the line for indicating the direction of the streams within the flow diagram. Arrows shall only be used at the inlets to equipment and machinery (except for pumps) and upstream of pipe branches. They shall not touch the outline of the graphical symbols.

NOTE: If a diagram is comprised of several sheets, it is recommended that incoming and outgoing flow lines or piping of a sheet be drawn in such a manner that the lines continue at the same level when the individual sheets are joined together.

5.3.4 Connections

Connections between flow lines or piping shall be drawn as shown in table 1, subject group 1.

5.3.5 Connections of secondary system lines

Secondary system lines shall be shown by short lines with indication of the direction of flow and reference to the type of energy carrier and possibly drawing number.

5.4 Inscriptions

5.4.1 Type of lettering

Lettering of ISO 3098-1 shall be used.

NOTE: The use of vertical letters type B is recommended.

5.4.2 Height of lettering

The height of letters shall be at least:

a) 3,5 mm for identification numbers of major equipment;

b) 2,5 mm for other inscriptions.

5.4.3 Arrangement of inscription

a) Equipment

Identification numbers for equipment shall be clearly allotted to the pertaining graphical symbol, but shall not be written into it.

NOTE: Further details (e.g. designation, nominal capacity, pressure, material) can either be placed under the identification numbers or indicated in separate tables.

b) Flow lines or piping

Designation of flow lines or piping shall be written above horizontal lines, to the left of and parallel to vertical lines.

If the beginning and end of flow lines or piping are not immediately recognizable, identical ones shall be indicated by corresponding letters.

c) Valves and fittings

Designation of valves and fittings shall be written next to the graphical symbol and parallel to the direction of flow.

d) Measurement and control functions

ISO 3511-1 and ISO 3511-4 shall be used.

e) Flow rates, operating conditions, thermophysical properties

Flow rates, operating conditions and thermophysical properties shall be entered either in horizontal rectangular boxes or in a separate table. The boxes shall be connected to the reference points by means of reference lines. If the data are shown in tabular form, a serial number corresponding to the data list shall be written into the box.

f) SI units

SI units shall be used in accordance with ISO 1000.

6 Selection of graphical symbols

6.1 General

The symbols of the ISO basic series given in table 1 are based on ISO 10628.

6.2 Series selection

The symbols of the ISO basic series shall be used in a system flow diagram. The symbols of the ISO basic and/or refrigeration basic series shall be used in a P & ID diagram.

NOTE: It is recommended also to use graphical symbols of the ISO basic series in P & ID diagrams, since very often it is not possible to show in a graphical symbol every special feature of the equipment. The special features are given in the equipment data sheets.

6.3 Subject groups

NOTE: The graphical symbols are grouped together in subject groups according to functional and/or design features. They are arranged in an ISO basic and refrigeration series and examples of application.

A distinction is made between the following subject groups:

- 1: Piping;
- 2: Shut-off valves;
- 3: Check valves;
- 4: Regulating valves;
- 5: Valves/fittings with safety function;
- 6: Valve actuators;
- 7: Pipe fittings;
- 8: Vessels and tanks;
- 9: Vessels with internals; Columns with internals; Chemical reactors with internals;
- 10: Facilities for heating or cooling;
- 11: Heat exchangers; Steam generators;
- 12: Filters; Liquid filters; Gas filters, filter-driers;
- 13: Separators;
- 14: Agitators;
- 15: Liquid pumps;
- 16: Compressors; Vacuum pumps; Fans;

- 17: Lifting, conveying and transport;
- 18: Scales;
- 19: Distribution facilities;
- 20: Motors, engines, drives.

6.4 Graphical symbols for equipment, machinery and piping

The graphical symbols given in table 1 shall be used.

NOTE 1: Graphical symbols are shown in the recommended sizes for flow diagrams (grid module M = 2,5 mm).

NOTE 2: Preferred flow line connections to a graphical symbol are indicated by an —Ⓐ in table 1. The indicated flow line connections are not a part of the graphical symbol. When flow diagrams are produced by means of computer aided design systems (CAD), flow lines can only be connected to a graphical symbol at grid points.

NOTE 3: The grid underneath the graphical symbol gives an idea of the proportions of the graphical symbol and facilitates its positioning and reproduction.

NOTE 4: Graphical symbols may be turned or mirrored, if their meaning does not depend on the orientation. The representation of some graphical symbols (e.g. columns, vessels, etc.) should be adjusted to the actual scale with respect to the refrigerating system.

NOTE 5: Symbols from different subject groups can be combined to form more detailed symbols.

Table 1: Graphical symbols for equipment, machinery and piping (continued)

Graphical symbols		
ISO basic series	Refrigeration series	Examples of application
Subject group 1	**Piping**	
	Refrigerant, refrigerant solutions; main circuit	
	Refrigerant, secondary circuit	
	Heat transfer medium	
	Cooling water for condenser	
	Other substances (e.g. oil)	
	Product to be cooled or heated (including water)	
	Flow/motion in direction of arrow	
	Arrow for inlet or outlet of essential substances	
		Outlet
		Inlet
	Piping, heated or cooled	
	Piping, insulated	

(continued)